ABSTRACT OF THE DISCLOSURE

A method for producing a lead-free gasoline composition having a sulfur content of 1 mass ppm or less and a research method octane number of 89.0 or more, which comprises a step of subjecting a cracked naphtha fraction exhibiting a temperature for 5 vol % distillation of 25°C or higher and a temperature for 95 vol % distillation of 210°C or lower, having an olefin content of 5 mass % or more and a diene number of 0.3 g/100 g or less to a desulfurization treatment, and a step of a blending step of mixing the above resultant desulfurized cracked naphtha fraction with another gasoline base material; and a lead-free gasoline composition which has a research method octane number of 89.0 or more, exhibits a temperature for 50 vol % distillation of 105°C or lower, has an olefin content of 10 vol % or more and a total sulfur content of 1 mass ppm or less, and has a percentage of a thiophene type sulfur compound in the total sulfur content of 50 mass % or more in terms of sulfur. The above lead-free gasoline composition has a sulfur content of 1 mass % or less and also retains satisfactory driving characteristics.